Harley Otto

Interview with Harley Otto

Interviewed by Professor Clarke A. Chambers
University of Minnesota

Interviewed on November 9, 1995

Harley Otto - HO
Clarke A. Chambers - CAC

CAC: This is Clarke Chambers, the interviewer. It is November 9, 1995. I'm interviewing this morning Harley J. Otto, who was with the university faculty for awhile and, then, took on with the Minnesota Crop Improvement Association. It's that story, primarily, we hope to get to. As I was suggesting at the beginning, it's valuable for people listening to this to know who you are. They're tired of me by now because I've done so many. We'll start out with a little autobiography. You say you were born in Kansas and reared there? We'll talk about your family and your education. Were you a farm kid?

HO: Yes. I grew up in the extreme southwest corner of Kansas in the southwest county of the state. It was a very sparsely populated of the country.

CAC: I've been through that country. What's the nearest town?

HO: The nearest town was Richfield; but that only had 100 people and nobody every heard of it. It's about 150 miles southwest of Dodge City, if you know where Dodge City, Kansas, is.

CAC: Sure, I've taken that hypotenuse that goes down toward New Mexico.

HO: That would be Highway 160, I believe. You go through Liberal.

CAC: Right, that's it.

HO: That would be the closest town and we were seventy-five west of there.

CAC: That's pretty severe country.

HO: It's very severe country.

CAC: [laughter]

HO: I was born in 1928; and so, I grew up during the middle of the Dust Bowl days.

CAC: Oh, my.

HO: That was the exact center of the Dust Bowl days. If you've read the *Grapes of Wrath*, which started in Oklahoma but it was very, very similar to where I grew up in Kansas. We were only twenty-five miles from the Oklahoma line.

CAC: Was it a family farm?

HO: Yes. It was eleven miles from Colorado. Our nearest neighbor was about five miles away from us. We went to school in this town of Richfield which had about 100 people in it. That was eight miles away. When I went to high school, there was only eight of us in the whole four years of high school. The nearest high school closest to that was maybe twenty-five or thirty miles away from it. The schools are quite changed now; but at that time, those were the kinds of situations we had.

CAC: How large an operation . . . how many acres did you farm?

HO: I don't recall right now but there was a lot of acres but relating that to the acres in Minnesota is not very meaningful because . . .

CAC: I know that.

HO: . . . it's such a different kind of country. It's very low rainfall. The main crops that are grown there are wheat and sorghums, grain sorghum. Since that time, there's been a lot of irrigation developed in the country and it's quite different than it was then. It's the center of one of the big livestock feeding areas. There's been a lot of oil discoveries and gas discoveries in that area since then; so, it's quite a different kind of country now than it was at that time.

Then, during World War II, I wasn't old enough to be in the service. My brother was and there wasn't anyone to work on the farm; so, I had to drop out of school and work on the farm for a few years. The second year I was in high school, I missed about eighty-five days of school to work on the farm and, then, I missed two years completely following that. So, I went back and finished high school and I was a rather advanced age when I finished high school. [laughter] I went from high school right on to college and went right straight through from there. I went first to Colorado State University in Fort Collins. It was known as Colorado A&M [Agricultural and Mechanical College] at that time. I went to school there two years. Then, I got an grant-in-aid from the Hawaiian Sugar Planters Association . . .

CAC: Ah.

HO: . . . to go to the University of Hawaii. The idea there was that you go and get training and degree in tropical agriculture, particularly in sugar cane production. The idea was that they would through this process develop people that could work on the plantations in technical capacities. But, I just went to school there one year and decided that I'd rather come back; so, I came back to Fort Collins then and finished.

CAC: Of course, Colorado had beet sugar?

HO: Yes, but that's quite a different kind of . . .

CAC: It must be.

HO: There's no relationship between the two. The end product that they get from the cane and beet sugar is the same, identical, but . . .

CAC: Eventually.

HO: . . . the crops and the process of getting it are quite different. When I was at the University of Hawaii, I was still in college so I was taking mostly the academic courses there, some in agriculture but also the more basic courses in history, and mathematics, and so on.

CAC: I should think that would have been pretty seductive to be in Hawaii after Kansas.

HO: Yes, it was. I could appreciate it more a few years later than I did right at that time. It was fun, and I have some very fond memories of it, and some of the people that were there with me are actually, one or two of them, are at the University of Minnesota now.

CAC: I see.

HO: Then, I came back to Fort Collins, and finished my undergraduate work there in agronomy; and, then, went to Cornell University, and worked on a Ph.D. in Plant Breeding, and finished that about three and one half years later.

CAC: I'm sure you were a good student but you must also have been well advised because Colorado and Cornell were two of the leading places for the work that you were interested in.

HO: Yes.

CAC: And you knew that? Did you get good advice along the line?

HO: Yes, especially at Colorado because there had been several people that were students there, that preceded me, that went to Cornell University also.

CAC: That was a natural line, wasn't it?

HO: Yes. I went there and got my Ph.D. in Plant Breeding in early 1956.

CAC: Specializing in some particular range of crops?

HO: It was pretty much with . . . my thesis work and my graduate assistantship work were in corn; but also, we studied the other crops as well.

CAC: Sure.

HO: Then, at the time I finished my Ph.D., the fellow who was my major professor . . . Cornell University had an arrangement with the University of the Philippines, an aid program . . .

CAC: Heavens.

HO: and Dr. Hayes, who was the head of the Agronomy Department here until about 1952 . . .

CAC: There are a lot of Hayes . . . what was his first name. Can you remember?

HO: Kendall Hayes.

CAC: Thank you.

HO: He was one of the first people that Cornell hired after he retired at the University of Minnesota to go to the Philippines. Then, a few years later, the fellow that was my major professor went for a year on that program and they asked me to take his place while he was gone and carry on his research program.

CAC: Here?

HO: No, this was at Cornell University.

CAC: Still at Cornell?

HO: Yes. So, I did that. Then, after he came back, there was another position they wanted me to work in; so, I ultimately spent a total of two years working at Cornell after I finished my Ph.D. degree.

CAC: You never linked up with the Philippine operation?

HO: No, no.

CAC: I interviewed Vern Ruttan. He was out there as an ag economist and the Rice . . .

HO: Yes, he was at the International Rice Research Institute. I know of Vern's background there some. At that time then, the job as extension agronomist at the University of Minnesota was available; so, I came here in April 1, 1958. I started as extension agronomist and assistant professor in the Agronomy Department. I worked in that job, and progressed to associate and full professor before too many years, and served for sixteen years in the Agronomy Department and with the Extension Service.

CAC: With a crop speciality?

HO: During the time I was there, I worked with most of the different kinds of crops in the state because as the faculty staff changed, there were different needs; so, I'd fill in as needed with the different kinds of crops. I originally came here to work on corn, and soybeans, and small grains. Bill Hueg was working on forage crops in the same program; so, we worked very closely together. As the years changed, sometimes I worked in forage work and sometimes in others. In the beginning years, there was a lot of interest in the . . . This was at the time the herbicides were coming along for controlling weeds in all the crops, and there were great changes taking place, and lots of interest in it; so, we had to fill in and serve as resource people for information on those herbicides, and carry on a program to help farmers understand what was good for their use in their parts of the state, and things of that sort. We spent quite a bit of time on that in the early years until about 1964 when the university then did get an Extension specialist in weed control. The Extension specialist are people who specialize in different types of work.

CAC: Oh, all right.

HO: You have field crops but some people work in field crop production maybe in the soil fertility aspect. Others might work in controlling weeds, and others in selecting varieties, and others in such cultural practices as when do you plant, and how thick do you plant, and all that sort of thing.

CAC: Although you were specially trained in plant genetics, you have to be very versatile in your research and outreach, right?

HO: Yes, and particularly in the positions at that time, more so than today I think, because there was fewer faculty people working on the programs. You had to be more general than most of the research people were and more flexible to be able to meet the needs of the farmers and the other people in agriculture that were out in the state. We had to be kind of loose, and try to learn everything we could about as many things as possible, and try to integrate this information

together. The research programs at the university are much more specialized and when you apply that specialized information on the farm, it has to be integrated with a lot of other kinds of information.

CAC: The practical?

HO: Yes.

CAC: Excuse me. I'm going to interrupt just a second to clarify it in my mind so people down the line can. You're suggesting that, in the mid 1960s, this changes in some fashion?

HO: As the university was able to do so, they were able to employ more specialists within the Extension Service and that allowed, then, those specialists working to specialize more than they had in the past. For example, when I first came here, there were two of us working in the whole of the crops production.

CAC: Oh, good grief. In all parts of the state?

HO: Yes, that's right. Later on, they got a specialist in weed control, and a specialist maybe in small grains, and another one in corn, and another one in soybeans; so, as the resources were greater then, this allowed more specialization among the people that were working.

CAC: Now, where did the increased resources come from in the mid 1960s?

HO: They were mainly, I think, from the state and federal appropriations.

CAC: Okay.

HO: I think that to quite an extent the organization I worked for later, the Minnesota Crop Improvement Association, an other organizations that had a real need for more education were able to convince the legislature that more money should be put into that activity; so, this helped in bringing about the increased resources and increased personnel that were available to do the jobs.

CAC: Those increased resources continued to increase into the 1970s?

HO: Yes.

CAC: And 1980s? Or does it begin to fall off?

HO: I guess I'm a little bit hazy on just when some of these things happened; but, it began to fall off in the 1980s mostly, is my recollection of it.

CAC: From interviews I've done with people in the Institute of Technology, and the Medical School, and all over the university, the expansion of research and outreach funds is a major story, as I see it, in the 1960s and 1970s; but then it all begins to slowly compress again.

HO: Yes, I'm sure the same thing is happening throughout the university and other institutions as well.

CAC: Of course. Did you come to specialize then when all this money came in?

HO: The first thing that happened was that Bill Hueg left the Agronomy Department and went in as assistant director to the Agricultural Experiment Station; that left me as the only one then working . . .

CAC: Good grief.

HO: . . . for a couple or three years before a replacement was finally hired for his job. Then, it was a couple of years after that, that finally, we're able to get the university to agree to set up a weed control specialist position in the Agronomy Department. I know that was in 1964.

CAC: That late?

HO: It was from then on that the expansion took place, I think, quite a bit.

CAC: This would be the access to resources but also to new technology . . . these herbicides?

HO: Yes, they all came along together. The research programs were expanding as well at that time. There were many new research people that were employed; so, it was an expanded technology. Our job as specialists in the Extension Service . . . We had appointments in the subject matter discipline and in the Extension Service; so, we were in a good position to take that research, and take it out, and help apply it on the farms. To me, this was the concept that was most important when the Land-Grant college idea was set up . . . to integrate the education with the research to help improve, in our case at least, the agricultural base of the country. I think it was extremely effective in improving the productivity of our farms and probably even more effective in that than it was in getting the marketing done and some of the other kinds of things that needed to be done.

CAC: Yes.

HO: I was involved in the agricultural production; so, I feel that I know more about that than I do the other disciplines.

CAC: Sure, of course.

HO: I think that the idea of the research programs and the education Extension programs working with the agricultural organizations to help the farmers of the state was extremely effective. If you look at the records on yield increases during those periods of time, they're phenomenal.

CAC: Pretty spectacular.

HO: The efficiency of the production of agricultural products in the United States is not matched anywhere else in the world during that period of time. I believe that the real basis for it was the research and education that took place in the Land-Grant colleges and working with all phases of agricultural industry as well.

CAC: Did you work through Experiment Stations as well?

HO: We cooperated with them.

CAC: This again is a skeleton kind of question. Roughly, how many such units were there in the state of Minnesota, Experiment Stations?

HO: At that time that I came here in 1958, there was one at—I'll have to name them off because I'm not able to just tell you how many right now—Duluth, Grand Rapids, Crookston, Morris, Waseca, Rosemont.

CAC: Six.

HO: Then, there was what they called an experimental field in southwest Minnesota that, eventually, turned into the Lamberton Experiment Station. A few years later, they closed the one at Grand Rapids but at different times, they've had them at different places. There's about six or seven of them around the state. Those are all part of the University of Minnesota. All of the people on the staffs there are all either faculty or staff members of the university as well as being located at those Experiment Stations.

CAC: Of those, Waseca and Crookston get a larger educational mission, right?

HO: Yes, they had a longer history of having a high school level education programs at them.

CAC: Yes.

HO: Eventually, those became college level training. Then, of course, there was a university branch setup at Morris; but that was not set up as an agricultural . . . that was more of a general education center. When I came here in 1958, there were high school programs at Duluth, and Grand Rapids, and Crookston, and Waseca. Those gradually were phased out and, then, the ones

at Waseca and Crookston both had two-year college programs. Since that, of course, Waseca has been closed and Crookston's been made into a four-year curriculum institution.

CAC: There are experimental plots here on the St. Paul campus?

HO: Yes, there are.

CAC: I should think being on campus, you really were housed . . . I mean, your home base was St. Paul?

HO: My home base was in the Agronomy Department on the campus.

CAC: This is pretty complicated. You have these agricultural departments like Agronomy, and Soils, and so forth. You have experiment stations. You have the Extension program to carry it out. That takes a good deal . . .

HO: It's more complicated than that though because every county has an extension office with county agents in it that are part of the program as well.

CAC: And each one has a 4-H? [laughter]

HO: Yes, the 4-H and the adult education programs are all part of the same program; so, it is very complicated and has lots of people involved in it.

CAC: Can you describe a bit more then, the coordination and the cooperation that had to exist between all of these different units, that all have to come together like that, and really coming together with the Land-Grant mission as you suggested?

HO: I think that one of the basic differences between the organization in Minnesota and in the United States . . . Most of the states have organizations about like they have in Minnesota. The big difference as I see it was tying the extension and the research work together in one organization, the university.

CAC: I see.

HO: In other countries, for example in Canada, the education extension work is a part of one part of the government and the research is part of another one. They're not necessarily tied together at universities . . . that's still another. They, physically, are separated in the other countries and report through different administrative channels. In my observation, it's more difficult to get real close integration of the work that way; whereas, in the U.S. and in Minnesota, we have the research people, and the Extension people, and the people who do the resident teaching on the campus all housed in one department of the university. In our case, it was in the Agronomy Department. Then, you have the Extension Service which is the organization that

coordinates this and carries out the work throughout the state. The specialists that are located in the departments are also part of the faculty of the Extension Service and through that channel, it gets all the Extension specialists in the different departments working together and cooperating on programs; and it turns out to be quite an effective way of doing it. For example, the people in Agronomy that are concerned with producing crops, and pastures, and plant growth and the ones in Animal Sciences Department that are concerned about milk production, and beef production, and swine production, things of that sort, their work can be brought together and coordinated through the Extension Service.

CAC: But it requires pretty effective and nimble administrative work, entrepreneurship?

HO: Absolutely.

CAC: I was thinking again of my interview with Bill Hueg that he was that kind of person that could kind of piece it all together, right?

HO: Yes, there were a number of people that could.

CAC: Name me some others who would be . . .

HO: Like Roland Abraham who was in the Extension Service and Skooly Rutherford was the director of the Extension Service when I came here . . . people like that and, of course, even before that, there were others.

CAC: It takes a special kind of talent, I'm guessing?

HO: And special interests.

CAC: Yes.

HO: You can't be interested in a narrow field or very introverted and be able to accomplish this because you have to be willing to work with other people, and to integrate what you know with what they know, and try to develop an educationally program that can be beneficial to the people that need it, and in working with the county extension staffs in carrying out the programs in those areas.

CAC: How often were you outstate?

HO: Oh, very often. Being a campus-based Extension specialist in Minnesota is one of the best ways of getting to know the geography of the state . . .

CAC: [laughter]

HO: . . . probably better than even somebody in the Geography Department because you're traveling through it all the time. I'd say that we were probably out 50 percent to 60 percent of the time throughout the state.

CAC: It also gave you access to greater Minnesota legislators?

HO: Yes, and to the people even more than the legislators. It was the people that are the constituents of the legislators.

CAC: Yes.

HO: It does a person in that kind of position a better opportunity to know more people throughout the state than most occupations would give you. I found that very good and very satisfying.

CAC: I might share with you that my father was a country doctor in Faribault County. Martin and Faribault County are among the richest in the state of Minnesota. It still just staggers me—I was reared there in the 1920s and 1930s—the wealth that that soil and those farmers could produce. My!

HO: Yes. That's some of the best in the Midwest, I think.

CAC: Yes. When I was a kid, it was all corn/hog and, then, the war came and after the war, the soybeans came in. Then, it was a changed kind of economy.

HO: That's right, yes. It's changing again now through, particularly, the changes that take place in the enlarging of the farm sizes.

CAC: Oh, my! You had to be sensitive to those economic and social issues as well.

HO: Oh, yes. You're forced to be. Your programs would be nothing without considering that. Another aspect of the work that I did was with the Minnesota Crop Improvement Association. The headquarters are located on the campus of the university. This is an organization that was formed in 1904.

CAC: That far back?

HO: Yes. It was started as an organization called the Field Crop Breeders Association. This was before the scientific research in variety development really started. That started from 1905 to 1920, during that time; but from 1904 and the mid-teens, most of the corn growers, for example, were saving the best ears out of their fields for their seed for the following year.

CAC: Of course.

HO: In doing so, they were making selections of genetic material that was best adapted to their own farm; so, each farm was developing a different strain.

CAC: Ahhh.

HO: Some of them would start from the same, for example, Minnesota-13 corn. It was an open pollinated variety that was grown. As the farmers, each one, selected from this, they got genetic material that was different from each other. There were also some of them that were selecting other individual plants and other crops and trying to improve the varieties that were available. This Field Crop Breeders Association was formed in an effort to give those people an opportunity to get together, and exchange material, and exchange ideas, and things of that sort.

CAC: But without the coordination, that early, of the university, not in the same degree at least?

HO: Yes, the university was not doing the research work at that time to the level they've done later. The start of the organization was aided and abetted by people at the university. Most organizations that get started like this have somebody that is helping to coordinate the people with the different ideas to get them going. The people at the university were working with some of . . .

CAC: So, they were engaged from the beginning?

HO: Yes, and started this organization.

CAC: The association itself was composed of individual farmers?

HO: That's right, yes.

CAC: And continued to be?

HO: And continued to be. Later on, as the research program developed and they had plant breeders in the Agronomy Department working on field crops, they were developing then varieties . . . in the beginning they were selections from the materials that were being grown on the farms or grown in other countries that were brought it and the new varieties came through that route of selections from materials that were being grown. Then, they started making crosses between these materials and exchanging germ plasm within the plants. This was the age of what I would call the <u>science</u> of plant breeding rather than the <u>art</u> of plant breeding.

CAC: Hybrid corn . . . the basic experiments were done in the 1920s and 1930s?

HO: The more basic ones were earlier than that, when they started studying the effect of inbreeding in corn and what this would do to the plants.

CAC: I was thinking Henry A. Wallace's career was then.

HO: Yes. He was in the beginning and there was a . . .

CAC: I'm thinking that in my country, that is, southern Minnesota, the wide application didn't come until the mid 1930s.

HO: No, that's right. By the standards of today, it was very slow development. Of course, it set the stage where people could see the benefits of this; so, subsequent developments have taken hold a lot faster than those did.

CAC: I see.

HO: The original work with the research and what happens if you inbreed corn was taking place mainly in the East, in Connecticut . . .

CAC: Out of the Corn Belt.

HO: Yes, it was a basic scientific work at Cold Spring Harbor in New York . . .

CAC: Good grief.

HO: . . . and in the University of Connecticut. Dr. Hayes who was one of the first heads of the Agronomy Department came from that program to here about 1915 to start this work here; and Minnesota, eventually, became a really important center for this kind of corn breeding research, in development of corn hybrids, particularly, for the northern part of the country.

CAC: Ah!

HO: There was a real difference in the environment, the climate, particularly in Minnesota as compared to Iowa or further south; so, the University of Minnesota became a real important center for development of these varieties that were used in the northern Midwest.

CAC: It's a shorter season all right.

HO: Yes. As this scientific plant breeding started, then, there were different needs. The farmers didn't need to coordinate their own breeding programs anymore. Along about 1918, I believe, was when the first hybrid corns were made; but of course, they weren't used on very many farms at that time. This gradually increased until in the 1930s and 1940s when the hybrid corn . . . It took about twenty years from the time hybrid corn was first developed until it was used on a very large percentage of farms.

CAC: Were there comparable advances with other crops, other seeds, the small grains?

HO: Yes, soybeans is an example of a plant that came here that wasn't adapted at all to this country. They used it mainly for a hay crop. The research was done with that crop that made it adapted it to this area to where it's become one of our most important crops not only in Minnesota but throughout the United States. A lot of that pioneering work was done here at the University of Minnesota as well, particularly, in developing varieties that were adapted to this area.

CAC: Colder clime. My neighbor, Jean Lambert, was a part of that.

HO: Yes, Jean was a very important part of that. I worked closely with him and with other people doing similar things. If we go back then to the teens, when this work was taking place, it was soon discovered that these varieties that were being developed and released to the farmers, as they grew them a few years, they were changing. The reason for that was that the farmers were not very careful in cleaning out their equipment, and planting on fields that were clean, and things of that sort; so, there was a need observed to set up a program where the genetic purity of these varieties could be maintained from the time they were developed in the research program until they were actually used out on the farms. That's where the Minnesota Crop Improvement Association comes into the picture . . .

CAC: Ahhh.

HO: . . . setting up a program for maintaining the genetic integrity of these crops. That's been the main function of that association, conducting what is called a seed certification program. This program was developed, and became a quite a large program in the state, and served as a basis for maintaining these varieties; so, that, say, twenty years after a variety is developed, you could get seed that you knew was genetically like the variety the plant breeder developed. Without this kind of a program, they soon lose the identity of those varieties and they would be quite a bit different.

CAC: The chief constituency, historically in the period you're talking about, 1905, 1920, 1930, was corn? Correct?

HO: That was the one in the beginning but as they started developing . . .

CAC: Then, the other ones come in?

HO: Yes, come in somewhat later. The Minnesota Crop Improvement Association . . . there's a history book you can get for those early years.

CAC: Oh, good! Who wrote that, do you remember?

HO: H.L. Thomas who was retired from the Agronomy Department of the university.

CAC: He wrote that approximately when?

HO: Early 1960s.

CAC: And carries the story all the way down to that?

HO: From 1904 up to that time.

CAC: That would be a good reference for any historian to look at.

HO: Yes, yes. There are copies of that in the library and the Minnesota Crop Improvement Association still has it.

CAC: So, part of the story is the outreach to a variety of crops then? You start out with corn as the chief but then it . . .

HO: Wheat was another important crop at that time. There were problems with wheat rust. Rust is a disease, a very devastating disease and there were other kinds of diseases that came along. One of the main functions of the researchers in plant breeding was to develop varieties that had resistance to the diseases as well as other important characteristics, high yield, good standing ability, and things of that sort for the various crops.

CAC: Was it on that score that [Elvin] Stakman really comes in, particularly with the rust problem?

HO: Yes, that's right, Stakman, and Hayes, and Dr. Elmer Osmus who was in the Agronomy Department. He was with U.S. Department of Agriculture. [laughter] That's another little sideline.

CAC: Go ahead.

HO: Another important thing that happened in the organization of the agricultural work in this country was the integration of the research in the U.S. Department of Agriculture with that in the states. A good part of that came about by the U.S. Government putting research workers in the Land-Grant institutions in the experiment stations. Speaking about Dr. Osmus reminded me of that. He, actually, was employed by the U.S. Government, was located in the Agronomy Department at the University of Minnesota, and he was carrying out in cooperation with Dr. Stakman and the other plant pathologists . . . conducting the research and developing these varieties that were resistant to rust.

CAC: Once you get into this, it's interdisciplinary right away?

HO: Absolutely, yes. It had to be; otherwise, it would never work.

CAC: That's right. It's a model of research and application which is not—I'm making a statement that's really a question—applicable . . . I don't see it operating in a large number of other places. This kind of integration and coordination of research and outreach and practice . . . you folks had the model for it.

HO: Yes, this to me is the model of what's supposed to happen with the Land-Grant institution.

CAC: Right, right.

HO: I think those people that developed that system had to be geniuses to come up with this kind of a system. [laughter]

CAC: Yes.

HO: I can't think of any other that would have accomplished what that did in the length of time that it did. It hurts you to see that sort of thing kind of going down hill now.

CAC: That's your perception?

HO: Oh, yes, yes.

CAC: Maybe, we can come back to that at the end?

HO: And maybe with the tape off, too, for some of it. [laughter]

CAC: That would have to be your judgment.

HO: I have some opinions about it.

CAC: Sure. Well, an important part of any story is the period of declension as well as progress.

HO: Yes.

CAC: Now, we're back to the 1950s. That was your commitment for seventeen years here. You were in the Agronomy Department but you had all these other . . . You weren't specializing in any given crop or . . . ?

HO: No. My main interest was at different times was different things; but, underlying it all was the seed aspects of making sure that we had good seed supplies of these varieties available and that farmers knew about them.

CAC: And you could maintain the integrity of them?

HO: And to help those farmers understand that if they were going to benefit from these varieties, they had to buy seed they knew was that variety. At various times, there was a lot of mislabeled seed in the market place or they'd buy from their neighbors and the neighbor would say it's this but it might not really be that. Part of the benefits of the needs of the farmer was to recognize the need to buy his seed that had been inspected and had been labeled by an unbiased third party and that was the people with the Minnesota Crop Improvement Association.

CAC: In the meantime, there is another aspect here; that is, you get private companies who are doing the seed experimentation also?

HO: Yes, and developing varieties.

CAC: Could you say something about the relationship of the operations you're talking about then to the great seed companies?

HO: The first of that work was done by the seed corn companies—you mentioned Henry Wallace—the Pioneer Company and various other seed companies. In the beginning, they got most of their germ plasm, that is, the building blocks to the hybrids they had, from developments at the University of Minnesota and the other Experiment Stations. One of the greatest contributions, I think, of the corn project at the University, was these inbred lines that were developed. Of course, they put them together in various kinds of hybrids and tested them; so, the seed growers knew what combinations to put together. The university even produced and supplied the seed of those inbred lines to the seed producer so they could produce these hybrids that had been grown and tested.

CAC: Without a patent or income . . . ?

HO: No, there was nothing . . . no strings attached to it. These inbred lines were made available not only to these seed growers that were producing what was called the Minnesota hybrids, Minn-hybrids, but to seed companies like Pioneer or a number of others that were developed. This inbred material was available to them and they put it together in, I suppose, the combinations that the university had worked with but they had started developing some of their own inbred development programs. They, then, could take this material from the universities and integrate it with what they were producing and produce superior hybrids.

[End of Tape 1, Side 1]

[Tape 1, Side 2]

CAC: You had contacts with the Farm Bureau, the Extension Division, with these seed companies, and with research, and the Experiment Stations . . . that's a real challenging, fun kind of job?

HO: Yes, it is. You get to work with a lot of people and it is very interesting.

CAC: And you're doing new things all the time.

HO: Yes.

CAC: If it's crop improvement, you're improving the crops.

HO: And you felt like it was doing people some good, too.

CAC: Right. Then, you change careers?

HO: Could we follow up on this . . . ?

CAC: Oh, you bet!

HO: The corn seed was the first one that private companies could work on because they could develop hybrids and they were secret so that they were different from their competitors. When they developed their inbred lines, they didn't tell people what inbred lines they went in to make up a specific hybrid. They were able to gain more profit from production and sale of the seed of those varieties. At the same time, there were a lot of people—some of these companies are still in business and you might even want to think about interviewing one or two of them if you haven't done it—for example, Enestvedt Seed Company at Scared Heart, Minnesota . . .

CAC: What is the name of the company?

HO: Enestvedt, E-N-E-S-T-V-E-D-T. Their farm is over a hundred years in the same family, and they've been in this corn business ever since it started, and they still are in it, producing hybrids under those names. They were very interested in having the university continue the research programs and developing materials that could be used. The private seed companies with their own research programs, in this area, corn was the main crop that these companies could produce, and sell, and make a profit on, a high enough profit that they could afford to have their own research programs. The reason they could do that was because they were hybrids and they keep the pedigrees of their hybrids secret so nobody else could produce them. As other crops developed hybrid potential, they went about the same way . . . grain sorghums—not in this area because those crops are not well adapted here—in the Great Plains area. In the South, the sorghums went the same way because they discovered how to make hybrid plants and they got the same advantages in hybrid vigor that the corn breeders had gotten earlier. The reason corn was one of the first crops that was handled in this way in making hybrids was because of the plant structure, where the female and the male flowers of the plant are in different parts of the plants; so, it's easy to control the pollination so you can make specific kinds of genetic combinations that are going to result in these hybrids.

CAC: All of us, as kids, went around, were hired, to put little paper sacks on the corn.

HO: Yes. In other crops, like the sorghum, for example, and wheat and many other crops, the flowers are formed with the male and female part both in a very tiny structure, with one flower for one seed. This makes the development of hybrids much more difficult from a mechanical standpoint.

CAC: I understand.

HO: The development of those hybrids had to wait on the idea that there was some method of developing male sterility in those flowers.

CAC: Ahhh.

HO: This came about through various genetic discoveries that were made in research programs. The sorghums . . . there were hybrids there and, then, sunflowers is another one; so, the private companies started working in that. The private companies were not able to make very much money in crops like wheat, and soybeans, and barley, and oats because these are self-pollinated crops; that is, that once you get the seed of one of those varieties and you plant it out, you can save your own seed the next year and have the same variety. With a hybrid, you can't do that because the resulting plants, if you save seed from a hybrid, are segregating genetically so they don't perform the same as they did previously.

CAC: I see.

HO: The hybrid crops were the ones . . . they were able to develop seed companies that could afford to produce and sell the seed.

CAC: That's interesting.

HO: There was no legal protection of this other than keeping what you're doing a secret from everybody else. Over the years, there was a lot of interest in some kind of patenting or something like that, some kind of legal protection for germ plasm. There was much talk about development of systems to do that. In 1970, the Federal Congress passed what's called the Plant Variety Protection Act. This, then, gives the owners of varieties of these self-pollinated or other kinds of crops, any kind of crop, the right to get this protection. It's not a patent because it's handled differently in the laws; but, it gives patent-like protection to these varieties that are developed. Through this Plant Variety Protection Act, the developer of a variety can apply for and get a certificate saying he owns that variety. Then, he can restrict other people from reproducing and selling that seed of that variety. The passage of that act, then, and the set up of those laws, brought more different kinds of plant breeding programs under the umbrella of private seed companies. They became more interested in it. Soybeans is one that has grown considerably and there's a lot of private plant breeding programs in soybeans.

CAC: But, these private companies have access to research at the University of Minnesota?

HO: Yes.

CAC: There's no way that you can protect?

HO: Yes, the university does protect their varieties.

CAC: Oh, all right . . . under this law?

HO: Yes. But the private companies and anybody can take those varieties under that program and cross them with their own varieties. Then, they can take those varieties and get the protection on them so that they have something that is somewhat different than the ones that were developed by . . .

CAC: There's no way for the university to get income from doing this work?

HO: Yes, there are and right now, they're developing a system to do more of that. The decision was only made by the university with respect to these field crops. The decision was only made within the past five years to try to do that.

CAC: That recent?

HO: Yes. Previous to that time, they were released with no restrictions on who could grow them and sell them; but within the last five or six years, there have been attempts made to capitalize on that for the university.

CAC: Would the same thing have been true of the development of fruit crops . . . the Haralson apple?

HO: No, no. Interestingly enough, they are handled completely differently.

CAC: That's a different story?

HO: I'm not really well-acquainted with that except to know that with the fruit trees and the azaleas that they have developed . . .

CAC: Right.

HO: . . . and the chrysanthemums—that's another big program—those are released through the Minnesota State Horticultural Society. They sell those to the various nurseries and the nursery, I believe, pays some money to the university. I'm not really well-acquainted with how that works because we had nothing really to do with that; but, I believe that's roughly the way it works.

Right now, they're undergoing a system of setting up a seed company and since I retired, I'm not well-acquainted with what's going on; so, I'm not able to talk about that. There are ways that they're trying to capitalize more securely on the developments from the university. This is fair enough, particularly, in these days when everybody is after more of the tax funds and it's much more difficult to get appropriations for any kind of research or educational work. The university is having a really difficult time the last few years. This is one way of having the farmers contributing more to that as they pay for their seed and, then, part of that money goes back into the research program, which is fair enough in a way.

CAC: I should think so.

HO: Another way you can look at it is . . . I really believe that the people that have benefitted the most from all this research, and education, and improved productivity in farming and in agriculture are you, and me, and all the other consumers in the country. We've benefitted more than the farmers have in this. The farmers have a harder time getting real benefits from it than we do. Why that is, is a pretty complicated story; and I'm not sure I understand it all but it has to do with marketing, and competition, and things of that sort.

[break in the interview]

CAC: Seventeen years after you came here in the late 1950s, you take up a related, but different, career. Say something about the attraction of leaving the university and doing this other work.

HO: Okay. The Minnesota Crop Improvement Association has always had someone from the university serving as the secretary on their Board of Directors. When I came here in 1958, the person that was in that slot was Dr. Rodney Briggs . . .

CAC: Oh, of course.

HO: . . . who then the next year—he was in the Agronomy Department at that time—went to Morris to head up the Agricultural Experiment Station out there. Eventually, when they formed the university, he became the first provost of the university there. He left that position and the secretary is elected by the Board of Directors of the Minnesota Crop Improvement Association and I was asked to serve in that capacity; so, I served on the Board of Directors of the association from 1959 to 1975. That was about sixteen years or so that I served as secretary.

CAC: But not as a paid officer?

HO: There was no pay. It was just to serve as the secretary, and participate in the Board meetings, and help them with developing there; but it tied in very closely and very well with the Extension program that I was conducting. It helped to integrate the work of the two, the Extension service and the organization. Then, in 1975, Ward Marshall, who had been the manager—he had been managing the association ever since, probably, the 1940s—died and the

Board, then, asked me if I would apply for the job, which I did and I was hired to take it over. I started October 1, 1975. He died in May; so, they really didn't have any manager from May until October of that year.

CAC: You found this a challenge to move out of the university—I know you're close to the university—and take this job for what reasons?

HO: I guess I'd have to say the main reason . . . There were a couple of them. One of them was that I enjoy that kind of work with seed work and I could devote a lot of my time to working with seed work, with seed producers, and seed consumers. The university work is only a part of what . . . Then, I had had an opportunity to get acquainted with a lot of people in that organization, and found them to be such good people, and so interesting that I wanted to do whatever I could to work with them. This allowed me, then, an opportunity to work very closely with these people who were members of this association, the farmers, the seed growers. There are about a couple thousand people throughout the state of Minnesota that participate in the program. The main attraction was the ability to work with them and, also, the opportunity to be in the administration of that organization, and to provide the leadership for making the organization strong, and make as good contributions as we possibly could.

CAC: But it was still in the context where you didn't have to give up your university contacts because your office was just forty feet down the road?

HO: Yes, I didn't have to give up the contacts. I did give up my retirement system and all that sort of thing but still had the contacts, yes.

CAC: Then, you were in that position for twenty years?

HO: Yes.

CAC: Can you say something about the relationship when you were in that position then, to the university, of this farmer's association basically, a seed association, to the university? Were there changes made while you were manager?

HO: Yes, there are always changes taking place; but, basically, we were still doing the same thing. The main function of the Minnesota Crop Improvement Association was to conduct this seed certification program; and previous to 1969, I believe, the responsibility for producing and maintaining the basic seed of these varieties the university developed was a project in the Agronomy Department. At that time, then, the Agronomy Department asked the Minnesota Crop Improvement Association, not only the Agronomy Department but the Experiment Station, to consider taking over that responsibility; so, they did that in 1969. We had the responsibility for maintaining this basic seed—it was called the foundation seed—of these varieties and making that seed available to the seed growers so they could produce the seed to sell to farmers. In this position, then, I had responsibility for both this foundation seed program and producing and

selling seed of the varieties developed by the university. In essence, it was a really close relationship because, after the varieties were developed, we were extending the seed out to the seed growers, and, ultimately, to the farmers. We also conducted this seed certification program, which consisted of maintaining the records of a pedigree of this seed as it went from the association to the seed growers and inspecting all of those fields that this seed was produced in to make sure that the seed was kept pure and the variety status was maintained on it. We had a staff of people that would inspect these fields. Around 6,000 fields in the state in a typical year . . .

CAC: Good grief.

HO: . . . had to be inspected at the proper time. Then, when that seed was harvested, it was taken to a seed cleaning plant to be cleaned and made in good quality for seed purposes. Samples of that were sent in to the seed laboratory, which we also maintained in the Minnesota Crop Improvement Association. A sample of every field of seed that was produced was sent in and analyzed in our seed laboratory to make sure of the seed quality. Once, that was done—there are standards that were published that it had to meet—once the seed meets those standards, then, it becomes certified seed. There's a tag that's put on the bags or a certificate that's issued if it's sold in the bulk. This, then, tells the buyer that this seed has been through that process; so, they know, then, that it is that variety that was developed.

CAC: With you as manager, they had person who knew the technical, the genetic, the plant part of it.

HO: And knew where to get the information if we needed it, yes. We worked very closely with these plant breeders because in increasing this seed from year to year, you have to be very careful that you're maintaining its purity. Inadvertently, that can be lost sometimes. The advantage the Minnesota Crop Improvement Association had in the foundation program was that they had these plant breeders that could be called on to come and look at some of those fields if necessary. They're the ones that developed the varieties, they should know most about them. If it was a barley problem of any kind, then we'd get the barley breeder, Dr. [Donald?] Rasmusson to come out, and look at it with our people, and make sure we were keeping things going the way they should be going.

CAC: It was a wonderfully challenging kind of position to have.

HO: It was. In trying to maintain the good rapport with all of these members and with the people in the university . . . that's quite a challenge.

CAC: With your members, it's both the seed companies and the farmers themselves?

HO: Yes.

CAC: So, you have that dual thing there plus the university connection. Is this a model that exists in other state universities? They all have crop improvement associations?

HO: They all have something similar to this. In some cases, it's organized a little bit differently; but, the basic principles that underlie it are the same. The others are differences in details of how they're operated.

CAC: It can be carried on even if the university that's connected to it, in one case or another, is not necessarily Land-Grant?

HO: They all are Land-Grant colleges though.

CAC: The ones that have this association with crop improvement?

HO: Yes, mostly.

CAC: This is a partnership that's there historically and still there?

HO: In some states . . .

CAC: Your connection in Iowa would be with Ames and not with Iowa City, for example?

HO: Yes. The one in Iowa is organized very similarly to ours. They have their offices on the campus just the same . . . Wisconsin is the same way. In some states, though, the seed certification program is run by the Department of Agriculture in the state. In Minnesota, the Department of Agriculture is primarily a regulatory body and a promotion body for the whole agricultural industry; but, in some states the responsibility for the seed certification program would be in the regulatory agency. Generally, those don't work as well. When you have an organization like Minnesota Crop Improvement Association where the members are the ones that it serves, there's a lot more interest in the organization than there is if it's some government agency doing it.

CAC: There you are.

HO: There's a very, very striking difference in the attitudes of people that work with it.

CAC: Is there a national association . . . umbrella over the . . . ?

HO: Yes, it's an international organization called the Organization of Official Seed Certifying Agencies. This organization dates back to 1918. That was started by a few Midwestern seed certification agency people from South Dakota, and Minnesota, and Iowa, and Wisconsin, and the Canadian people because there's a lot of seed that moves from Canada to the U.S. and vice

versa. This organization needed to standardize standards and procedures and to facilitate this movement of seed across these borders.

CAC: This is an heroic story of various segments of the population joining in partnership. As you tell the story, it certainly is a success story and an heroic one; but, there must have been some downsides? Could you share with us where the problems come up, what problems you have to overcome?

HO: The problems of the association are the problems of the members because the association exists for the members, to serve the members. Historically, the main membership of the association had been the individual farmers and small seed companies that had taken the varieties the university had developed, increased the seed, and made that available to people in their neighborhoods and other areas for them to grow commercial crops. With the advent of the Plant Variety Protection Act and more private plant breeding programs, this served as competition for the public varieties. I think that one of the main downsides has been this kind of thing. Most of those companies that are producing this seed of private varieties chose not to certify it. Seed certification is a voluntary program. They chose not to because they were able to sell the seed without it. This, then, is one of the challenges that continues as to how to maintain this program to serve the farmers and how to get these varieties that are developed by the university out . . . to use them. That, I think, has been one of the main downsides. Other than that, as far as the work with these people in the association, I didn't find any downside there. It was all a great pleasure and I enjoyed it.

CAC: How does an outfit like Archer Daniels [Midland - ADM] relate to these [unclear]?

HO: Archer Daniels would be one that is more of a consumer of the products that are developed rather than in the seed business.

CAC: They have a pretty deep interest in having good seed.

HO: Yes, because they want to buy grain that is known genetically . . .

CAC: You bet.

HO: . . . so, that would be their main interest as a consumer.

CAC: Do they help finance or underwrite or relate in any way to this program?

HO: Not really. They would be more involved with the Food Science Department or departments that are associated with utilization of the crops that are produced . . . in making alcohol or whatever products it is that they ADM most interested in.

CAC: Oh, corn syrup by the tons.

HO: Corn syrup and alcohol. They are one of the biggest manufacturers of ethanol in the world. Companies like Cargill, for example, have their own seed department; so, they're involved in producing and selling seed as well as buying. They are an extremely diversified company in agriculture and they would be interested in that. As far as a direct relationship with Minnesota Crop Improvement, we cooperated with them and tried to keep in touch with what was going on with them, what their needs were and so on; but weren't able to involve them very directly in the seed certification programs because they were working mainly with hybrids and the tradition that those were not certified. Some other companies like Northrup King Seed Company, for example—which used to be a very diversified seed company; they're not so much anymore—we worked closely with them, particularly, with their grass seeds, and legume seeds, and crops like that they produced in northern Minnesota. They're not involved in that anymore. The company has narrowed their interests pretty much to corn, I believe now, and a few other crops; but, over the years Minnesota Crop Improvement Association worked with them in certifying seed of those varieties.

Another aspect of the work that became quite important, starting about 1960 and gained strength was the production in Minnesota of varieties that were developed in Europe, particularly, grass crops like timothy—timothy was the biggest one; but, there were some others, too—where varieties were developed in Europe. But they didn't have the climate and the land to produce the seed; so, growers in northern Minnesota, being the entrepreneurs that they were, discovered that they could produce the seed in northern Minnesota. We developed quite an industry up there of bringing seed of those varieties into Minnesota, producing the seed here, and exporting it back to those countries. This was one of the places where Minnesota Crop Improvement Association and the seed industry worked very closely together. Northrup King, when there were in that business, built a big seed plant at Roseau. They had contacts in Europe for obtaining seed and knowing which varieties. They would bring that seed of those varieties over here, and our growers would plant it, and grow it, and they'd send it back. Northrup King, eventually, went out of that business and another company called Northern Farm and Garden bought their business up there. There are several companies in northern Minnesota that have contributed a lot to the economy of that part of the state through this kind of seed production.

Another interesting story is the one about Park Kentucky bluegrass. Park Kentucky bluegrass was developed in the Agronomy Department at the university with Dr. Thomas and Dr. Hayes involved in that. It was one that was developed and released in the mid 1950s. Some of the growers up there, Charles Habstritt in particular, and Gus Greene, and some of those people found out how to produce that seed and developed this system for conditioning the seed so it could be purified and made in good condition to sell to people that wanted to buy that grass seed. That became a real contributor to that part of the state up there.

CAC: Heavens.

HO: Those things have been, in my opinion, a really important part of, you could call it, community development or the development of the agriculture of that part of the state.

CAC: Does any of it involve vegetable seeds?

HO: No. There is practically no vegetable seed grown in this . . .

CAC: That's an entirely different . . . ?

HO: Yes, that's grown mostly in California, and Idaho, and other places like that. It doesn't involve vegetables. Another development in the 1980s was the development in Europe of a soybean production industry. That came about in Europe primarily because the common market countries, the economic community, paid really high subsidies for growers to produce oil seed crops in Europe. It turned out that the varieties that are adapted to Minnesota were adapted in Italy for certain areas and certain parts of their farming operations. We were producing a lot of soybean seed in Minnesota that was exported to those countries. All of that seed had to be certified by the Minnesota Crop Improvement . . . that was a requirement under the laws in Europe. In one year—I can't remember just which year it was but it was in the late 1980s—we certified in this state for export to Italy over 900,000 bushels of soybean seed.

CAC: Good grief!

HO: It was certified under a little different program; so, we had records on which part was intended for export. Then, they changed their subsidy system over there and that ruined that business completely. [laughter] A lot of people made a lot of money on producing and exporting that soybean seed for a number of years. Government programs influence very heavily what happens with these sorts of things.

CAC: Sure. Would this have been a source of some of the downside that you were hinting at earlier, that maybe in recent years the model that you've been describing begins to falter in some ways? Could you share any of that?

HO: I think one of the things is that within the university, there's been, in my opinion, a de-emphasis of agriculture. I don't know if you saw the Minneapolis paper . . . Mike Martin is the new dean of Agriculture and in the Minneapolis paper about mid October was an interview with him. I'm sure that he was not accurately represented in what was printed there. I haven't had a chance to talk to him about it; but, I can't believe that the way that was presented would be really true of his intentions in operating the College of Agriculture. The emphasis was much more on the city people than on agriculture. Some of this, I suppose, it is inevitable because the constituency for agriculture in the legislature is much less than it was.

CAC: Yes.

HO: It's had several reapportionments and so on. This emphasis, then, has taken away a lot of the programs that had been developed in the past so that there is not that kind of emphasis on plant breeding research that there was in the years past.

CAC: I see. This has been in the last five, six, eight years?

HO: Yes, and I see this going down pretty rapidly and pretty drastically.

CAC: So, the university internally is not putting the same priority on those programs?

HO: Much less priority. I can see some of this; but, at the same time, I believe that one of the strengths we've had in this country has been—in the Land-Grant colleges now—not only the integration of research and teaching and Extension education but the integration of the basic research and the applied research and you need both of them. The basic research is very important. There have been a lot of big discoveries made in genetics that have implications not only in agriculture but in other fields as well that have come out of these research programs with plants in the Agronomy Department and others. It seems to me that for the benefit of agriculture, the agricultural industry, that keeping a strong applied research program as well as the basic research program is important.

CAC: You have a sense that some of that is beginning to come apart?

HO: Yes. If you depend on private seed companies or other private companies to do all of this, you lose some of the closeness between the basic research and the application. That, then, goes to more of the concept and the model that you find in European countries and places like that which, in my opinion, haven't been as effective.

CAC: It must relate in some way to the decrease in funding available for the university in general? Is that correct?

HO: And I think the general feeling among all the citizens is that agriculture is not as important because we don't have any trouble getting plenty of food and at a reasonable price; so, their successes have been their downfall.

CAC: I see. There is an irony there all right. It's difficult. In the 1930s or even as late as the 1950s, there was still a substantial number of your constituents in greater Minnesota who were there and that constituency is smaller.

HO: But in my opinion <u>all</u> the people of the state should be constituencies of the research because we all benefit from it.

CAC: Right, I understand.

HO: The benefits are not as obvious to people that are living in cities and are benefitting from this. Most people take it for granted that their food all comes from a grocery store. They don't know how it gets to the grocery store in the first place and what the contributions are of these people that are out on the farms producing it.

CAC: The faltering of this model, to some degree, is reflected in different ways in Engineering and in the Health Sciences.

HO: Sure, absolutely.

CAC: In the Health Sciences, for example, you have to have the same model of basic research, and applied research, and outreach, education of nurses and doctors.

HO: Right.

CAC: And if the funding begins to shrink, then other choices have to be made.

HO: Yes, that's right. I'm glad I'm not in a position of the people that have to make those decisions.

CAC: It's clear from so many interviews I've had that the pressures the last ten years are just of another order.

HO: Oh, yes.

CAC: Just terrible. Well, we've covered an enormous [unclear], a very exciting one. You've still got one more thing?

HO: Somehow it didn't work in there but . . .

CAC: Okay, you go ahead.

HO: The contributions of not only Minnesota Crop Improvement Association but some other organizations to the funding of the university, it seems to me, is an important and interesting aspect historically. Many of the buildings that are located on the St. Paul campus . . . I wouldn't say they wouldn't be there but maybe wouldn't have been there as soon if it hadn't been for organizations outside the university that saw the need for this and helped to work with the legislature to get the funding available for it. Remember back in the beginning here when we were talking about the wheat rust problems and the epidemics they had in the 1920s and 1930s? This is another example of relationships with the industries. The milling industries set up an organization called the Rust Prevention Association. It was funded, primarily, by the milling companies, General Mills, and Pillsbury, and all the other companies that were buying wheat to make flour from it. They got interested in this because in years when wheat rust was bad, it devastated the crops; so, they didn't have wheat to buy to run through their flour mills.. They set up this Rust Prevention Association. That was headed up by a fellow named Don Fletcher. There was another organization called the Northwest Crop Improvement Association that was also funded by these industries. That one was headed up by a fellow named Henry Putnam. Those organizations, when I came here in 1958, were both real strong organizations. Particularly,

the Rust Prevention Association and Don Fletcher, the person that he was and the interest that he had working with the university people, were very instrumental in getting funds for many of the research laboratories that are located over here on the St. Paul campus. I think they contributed considerably to the development of these programs in Agronomy and other departments there. Their insistence always was that these different departments working on crop production all be housed . . . have some parts of these departments in each one of the buildings so they could get those departments working closely together. I think it helped a lot in doing that. They also were instrumental in getting other kinds of funds from the federal and the state governments into the university for research programs and Extension programs at that time. These two organizations of Northwest Crop Improvement and Rust Prevention Association, when Henry Putnam retired, were combined. They were both financed by, essentially, the same companies; and they were combined into the Crop Quality Council, which operated for several years after that but it's extinct also. That was the way the milling industry in particular supported the getting of the funds and carrying out programs. Minnesota Crop Improvement Association also has been very active in lobbying and working with the legislature because they have . . .

[End of Tape 1, Side 2]

[End of the Interview]

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